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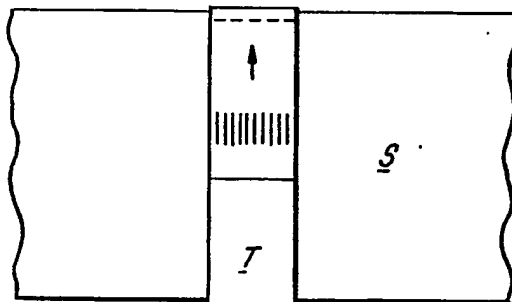
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54 Banding method and apparatus.

57 A method is disclosed for wrapping an object such as a stack (S) of banknotes with a length of tape (T), in which the tape is wrapped automatically around the object with opposite ends of the tape overlapping, and heat is applied to the overlapping ends of the tape only along a plurality of substantially parallel strips extending in the direction of the length of the tape so as to bond the ends together only at those strips. The heat seal so formed resists shearing forces which occur during the normal handling of the stack of banknotes, but is easily undone by peeling back the tab formed as the end of the tape.

Apparatus for carrying out this method includes a retractable heater assembly for clamping the overlapping tape ends, cutting the desired length of tape from a supply spool, and applying heat by means of an electric resistance heater. The electric resistance heater element is generally formed in a «zig-zag» pattern to obtain the parallel strips.



~~De La Rue Systems Limited~~

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BANDING METHOD AND APPARATUS

The present invention relates to a method and apparatus for wrapping an object with tape, and is particularly useful for wrapping stacks of banknotes with plastics tape.

5           In machinery for dispensing banknotes, it is sometimes desirable to wrap individual stacks of banknotes with banding tape. The banding operation should be completely automatic, and the seal should be strong enough to keep the stack  
10 together until the banknotes are to be used, but the band should not be too difficult to remove. Automatic banding apparatus is already known, for example the sheet binding apparatus described in U.K. Patent Application No. 2077655A. Tape is wound  
15 around a stack of sheets, and then the overlapping ends of the tape are sealed together by an electric heater; the heater assembly also cuts an end of the tape from the tape supply.

20           It is an object of the present invention to improve the seal formed between the ends of the wrapping tape, in particular to make it highly resistant to shearing forces and yet easily removable by a user.

The present invention consists in a method of wrapping an object with a length of tape, comprising the steps of: wrapping the tape around the object with opposite ends of the tape overlapping, and applying heat to the overlapping ends of the tape along a plurality of substantially parallel strips extending in the direction of the length of the tape so as to bond the ends together substantially only at those strips, whereby the heat seal so formed resists shearing forces, but is easily  
5  
10 undone by peeling back an end of the tape parallel to the said strips.

Apparatus according to a preferred embodiment of the invention for carrying out the above method includes a clamp for holding the said object, means for wrapping  
15 the tape around the object, means for holding two overlapping ends of the tape, and a retractable heater assembly for applying heat to a plurality of substantially parallel strips of the overlapping tape ends. The heater assembly preferably includes a heater block with an  
20 electric resistance heater element of such a configuration that only strips of the surface of the heater to be applied to the tape become sufficiently hot to seal the tape. The heater may be powered continuously but is preferably switched on only when the heater assembly  
25 engages the tape for the sealing operation.

The heater assembly preferably also includes a blade mounted to travel with the heater towards and away from the tape, arranged such that the blade cuts a length of tape from a continuous supply of tape just  
30 before the heater engages the surface of the tape. In the preferred embodiment of the invention, the blade is so shaped and positioned that after the tape has been cut the exposed end acts as a tab for subsequently peeling back the end of the tape and undoing the seal.

In order that the invention may be better understood, a preferred embodiment will now be described with reference to the accompanying drawings, wherein:-

5           Figure 1 is a view of a tape band wound around a stack of banknotes, the band being sealed along a series of parallel strips in accordance with a preferred form of the invention;

10           Figure 2A is a side elevation of a retractable heater assembly in accordance with a preferred embodiment of the invention;

            Figure 2B is an end view of the heater assembly of Figure 2A;

15           Figure 2C is a plan view of the same heater assembly; and

            Figure 3 is a sketch of an electric resistance heater element which can be employed in the heater assembly as an alternative to the wire element shown in Figures 2B and 2C.

20           The principle of the invention, illustrated in Figure 1, is that by sealing the overlapping ends of the tape band T only along a series of parallel, or nearly parallel, strips, of which 10 are shown in Figure 1, the tape band is resistant to the shearing forces resulting from the normal handling of the stack S of banknotes, and yet can easily be removed by lifting the tag formed by the end of the tape. The parallel strip seals are easily undone when the tag is lifted and peeled back in the direction of the arrow in Figure 1, i.e. along the length of the tape band.

30           The seal may be formed as follows. The stack S of banknotes is wrapped with tape from a tape supply spool, and overlapping portions of the tape are held over a platen facing the stack.

35           Referring now to Figure 2A, a retractable heater

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assembly 6 is advanced by a rod 12 in a direction parallel to the rod 12 towards the overlapping portions of the tape on the platen. The heater assembly is advanced leftwards until a sprung clamp 2 clamps overlapping portions of the tape onto the lower part of the platen (not shown). It is assumed for the purpose of this description that banding tape is fed from a supply spool located above the heater assembly 6 of Figure 2A. While the sprung clamp 2 holds the tape onto the platen, a blade 3 is advanced still further, against the force of the spring 11, and cuts off the desired length of tape for banding. The blade 3 is shown in greatest detail in Figure 2C which is a plan view of the heater assembly shown in side elevation in Figure 2A. The blade 3 is so positioned as to leave a tag on the cut end of the tape, the tag (shown in Figure 1) facilitating the subsequent removal of the band from the stack when the banknotes are to be used, as described above.

A heater 1 and the blade 3 are mounted together on an assembly which can be advanced further leftwards against the force of the spring 11, while the sprung clamp 2 remains in position against the platen. For the safety of an operator, a guard 4 protects the blade 3; the guard 4 moves with the sprung clamp 2.

The blade 3 and heater 1 are thus advanced from the retracted position of Figure 2A to an operative position at which the blade 3 is free of the guard 4, when it cuts the tape. Shortly after the tape has been cut, the heater 1 engages the overlapping ends of the tape and pushes them against the platen. At this point, a heater element 13, Figure 2B, is energised with a pulse

of electric current supplied through terminals 15, and the face of the heater block 1 engaging the tape ends reaches a high temperature only at a plurality of substantially parallel strips corresponding to the areas to be sealed. The heat from the heater block 1 seals the band in the platen area, and after the band has cooled the heater assembly 6 is retracted.

The heater 1 will now be described in greater detail. The heater element 13 of Figure 2B consists of a length of exposed wire, wound in a zig-zag fashion around formers on the block. The element is wound around the heater block using a jig. The element is then clamped to the heater block using a removable clamp. The jig is removed and the heater loops, at the ends of each parallel element, are bent at right angles to the front face of the heater and are bonded to the heater block. When the adhesive is cured, the clamp is removed leaving a series of parallel elements, proud of the heater face.

A similar system uses an etched heater element, as shown in Figure 3, which is bonded to the block in a similar fashion.

For either of the above forms of heater the element can be chosen from any of a variety of materials, depending on the life required and the type of driving circuit used. In a constant energy system, the heater is supplied with a selected voltage for a certain period of time and the supply is then switched off. In a temperature sensing system, an electrical bridge circuit regulates the electricity supply to the element in accordance with the temperature. The resistance of the heater changes with temperature and this is used to regulate

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the temperature; for this system, an element with a high temperature coefficient of resistance is used.

5 In the example of Figure 3, the element consists of a zig-zag pattern with exactly parallel strips, there being twelve pitches of 1.6 mm. The internal radius of each of the 180° bends of the zig-zag pattern is 0.65 mm. The overall length of the element is around 40 mm.

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CLAIMS

1. A method of wrapping an object with a length of tape, in which the tape (5) is wrapped around the object (8) with opposite ends of the tape overlapping and the overlapping ends are sealed, characterized in that the sealing is effected <sup>by</sup> applying heat (1) to the overlapping ends of the tape along a plurality of substantially parallel strips extending in the direction of the length of the tape so as to bond the ends together substantially only at those strips, whereby the heat seal so formed  
10 resists shearing forces, but is easily undone by peeling back an end of the tape parallel to the said strips.

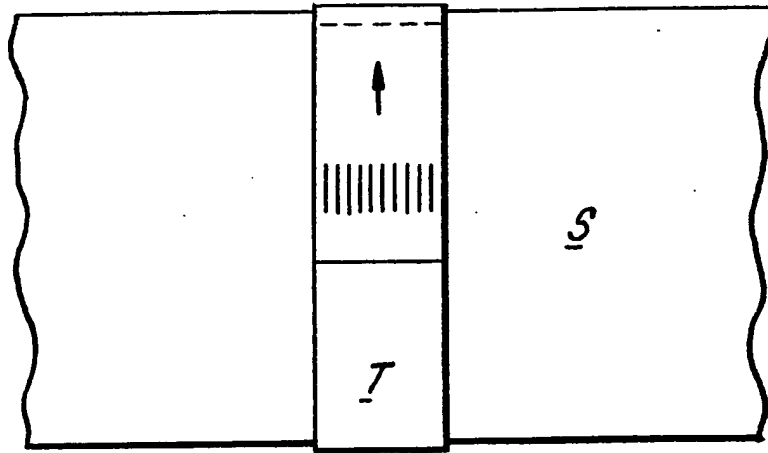
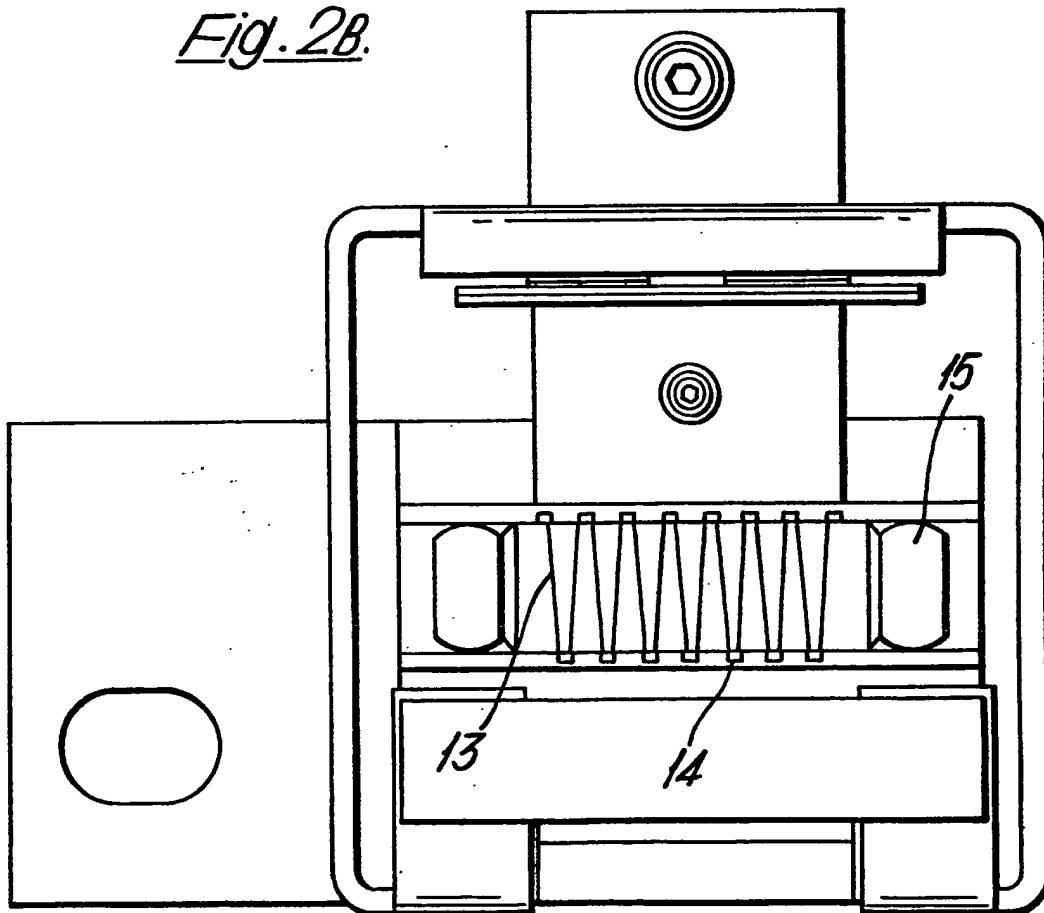
2. Apparatus for wrapping an object with a length of tape, comprising: a clamp (7) for holding the said  
15 object; means for wrapping the tape (5) around the object; means for holding two overlapping ends of the tape; and a retractable heater assembly (1) for applying heat to a plurality of substantially parallel strips of the overlapping tape ends, the strips extending in the  
20 direction of the length of the tape, whereby the heat seal so formed resists shearing forces, but is easily undone by peeling back an end of the tape parallel to the said strips.

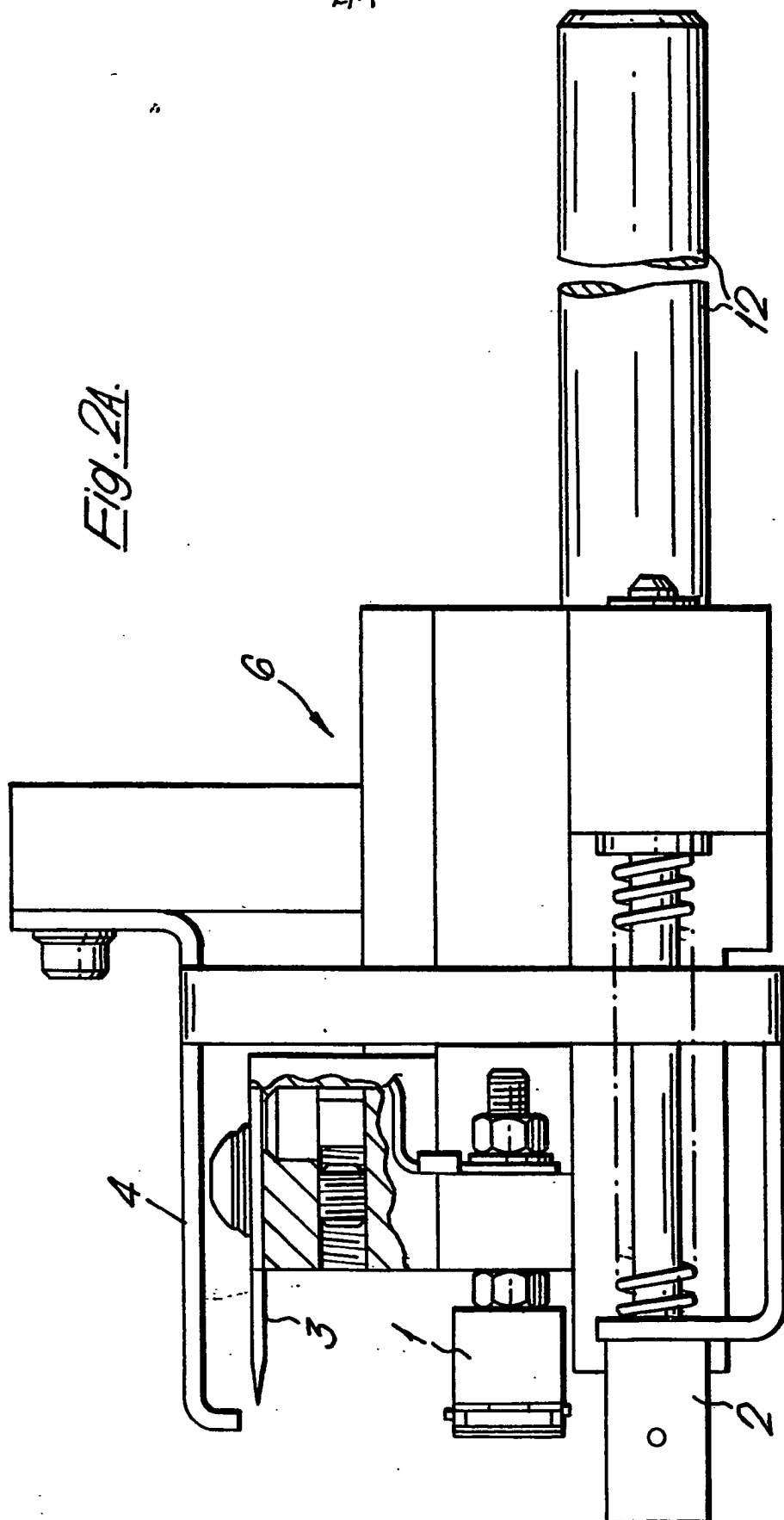
3. Apparatus in accordance with claim 2, wherein  
25 the retractable heater assembly (1) includes a heater block with an electric resistance heater element (13) of such a configuration that only strips of the surface of the heater to be applied to the tape become sufficiently hot to seal the tape.

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4. Apparatus in accordance with claim 3, wherein the electric resistance heater element (13) is wound in a "zig-zag" configuration, in which the bends are constituted by semicircular portions of the element.
- 5 5. Apparatus in accordance with claim 2, 3 or 4, wherein the heater assembly (13) is powered only when it engages the tape for the sealing operation.
6. Apparatus in accordance with any of claims 2 to 5, wherein the heater assembly includes a blade (3) mounted to travel with the heater towards and away from the tape, arranged such that the blade (3) cuts a length of tape from a continuous supply of tape just before the heater (1) engages the surface of the tape.
- 10 7. Apparatus in accordance with claim 6, wherein the blade is so shaped and positioned that after the tape has been cut the exposed free end acts as a tab for subsequently peeling back the end of the tape and undoing the seal.

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Fig. 1.Fig. 2B.

*Fig. 2A.*

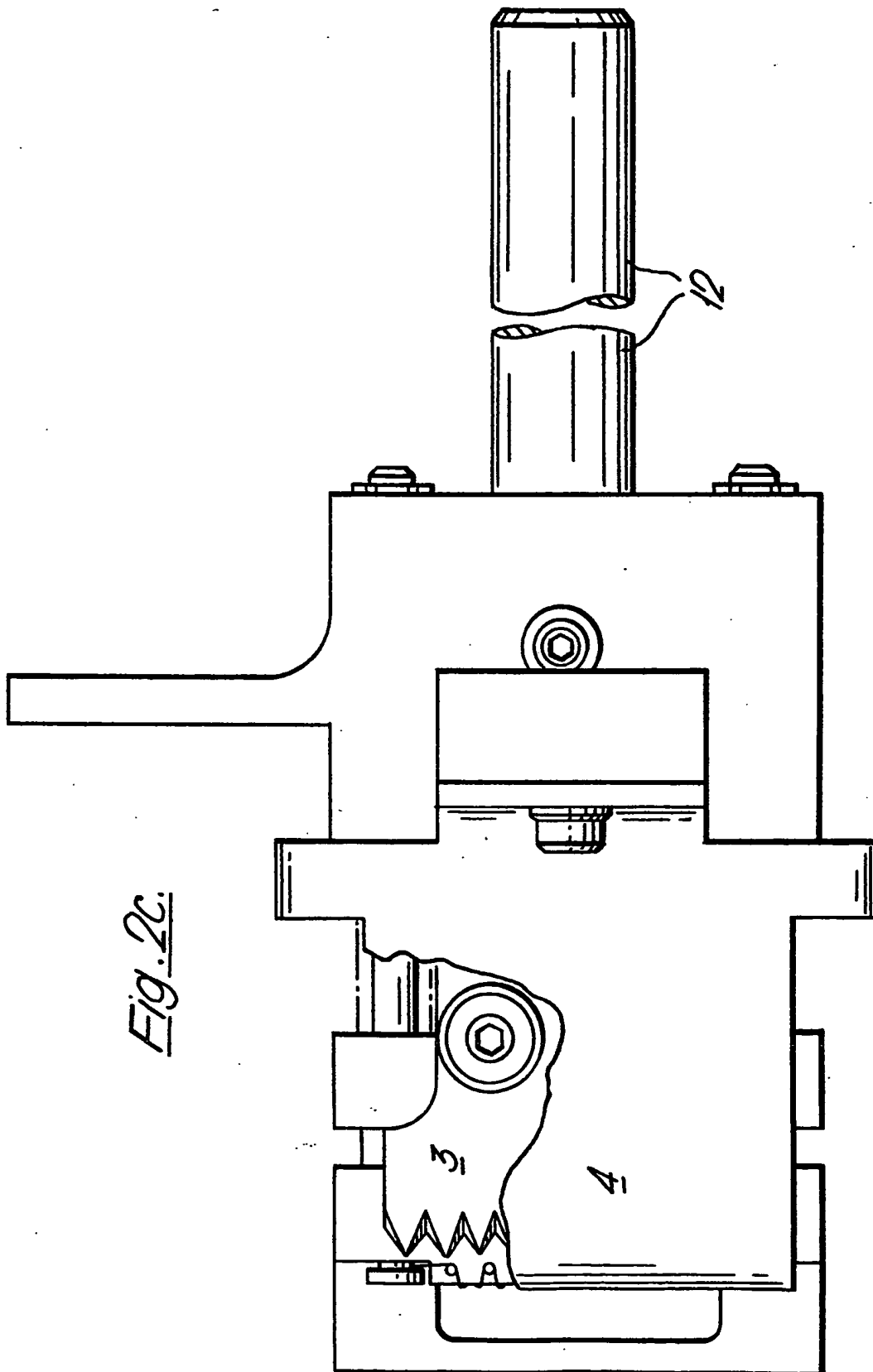
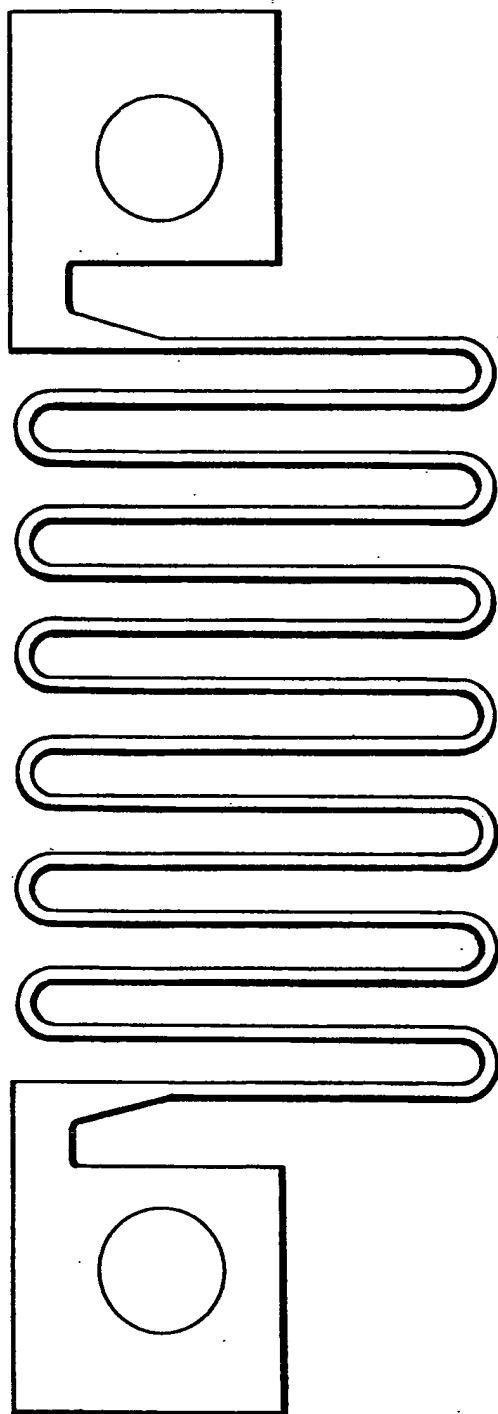


Fig. 2c.

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Fig. 3.





European Patent  
Office

# EUROPEAN SEARCH REPORT

0095915

Application number

EP 83 30 3084

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
X	US-A-3 788 933 (SEINOSUKE NAKAZAWA) * Column 3, line 55 - column 4, line 68; figures *	1, 2, 3, 6	B 65 B 27/08 B 65 B 13/32
A	US-A-2 982 063 (W. COLEMAN) * Column 1, line 65 - column 2, line 64; figures * -----	5, 7	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
			B 65 B B 65 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08-09-1983	Examiner JAGUSIAK A.H.G.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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